ARCHITECTURAL PROGRAM

National Institute for Aviation Research (NIAR) Renovation/Addition

to accommodate the

Advanced Technology Laboratory for Aerospace Systems (ATLAS)

Sectors A and E

May 2019

Wichita State University

Office of Facilities Planning

NIAR Renovation/Addition
ARCHITECTURAL PROGRAM

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INTRODUCTION

In order to meet such an aggressive demand, aircraft manufacturing processes must undergo significant technology advancements and future manufacturing engineers must be equipped with advanced hybrid, scalable, flexible, and extensible tools to adapt to growing complexities. With the advancement of sensor technologies and manipulators, industrial robots are now capable of performing non-routine complex functions such as labor-intensive advanced composite layup that typically require meticulous, trained technicians. Rapid tooling concepts with additive manufacturing technologies coupled with automated fiber placement (AFP) has the potential to significantly decrease lead-time with increased material yield and production rates due to fewer interruptions and improved consistency. With the use of advanced sensors, process simulation software, and in-process inspection systems, labor-intensive nondestructive inspection for quality assurance can be automated for minimizing interruptions and to significantly improve part quality. In-process inspection systems equipped with advanced sensors can be deployed for automatically identifying manufacturing defects and feed digital information into machine learning algorithms to take corrective actions on subsequent manufacturing runs to improve part quality. This approach, which develops a digital manufacturing twin for supporting sustainment activities, also fits well into the *Factory of the Future* concept and will aid in increasing production rates of commercial and defense aircraft.

In order to successfully integrate traditional design and manufacturing processes with novel advanced technologies, manufacturing engineering education programs must be enhanced to prepare future engineers with tools and applied learning experience necessary to apply scientific, mathematics and engineering principles during production to meet demands.

The National Institute for Aviation Research (NIAR) has a rich history of conducting research and providing an applied learning experience for all aspects of manufacturing activities, including providing area high school students with necessary design tools and hands-on training to accelerate their undergraduate and post-graduate education. NIAR has partnered with industry leaders in simulation, design, and manufacturing to develop an advanced manufacturing center on the WSU Innovation Campus to bring together large and small businesses, defense contractors, research enterprises, academia, university researchers, students, support organizations, and government agencies in order to accelerate innovation by investing in industry relevant advanced manufacturing technologies. NIAR Advanced Technology Laboratory for Aerospace Systems (ATLAS) has several strategic partnerships with government agencies, aircraft manufacturers, equipment suppliers, material suppliers, and other universities.

The mission of ATLAS is to develop a multi-disciplinary manufacturing engineering education program to prepare engineers and educators for the *Factory of the Future* and to aid the current workforce in seamlessly adapting to advancements in the workplace. ATLAS provides a

training ground for manufacturing engineers and students to get hands-on experience with industry-standard manufacturing equipment, design-simulations-analysis software, and inspection tools that are essential to the manufacturing workplace. ATLAS has received significant funding from the Office of Naval Research, Department of Commerce, Department of Defense, and the State of Kansas to acquire advanced manufacturing equipment as well as inspection and test systems that will be instrumental for the development and execution of the training programs.

ATLAS anticipates additional Department of Defense funding in calendar year 2020 and 2021 which will be housed in this proposed building addition.

PROJECT SCOPE

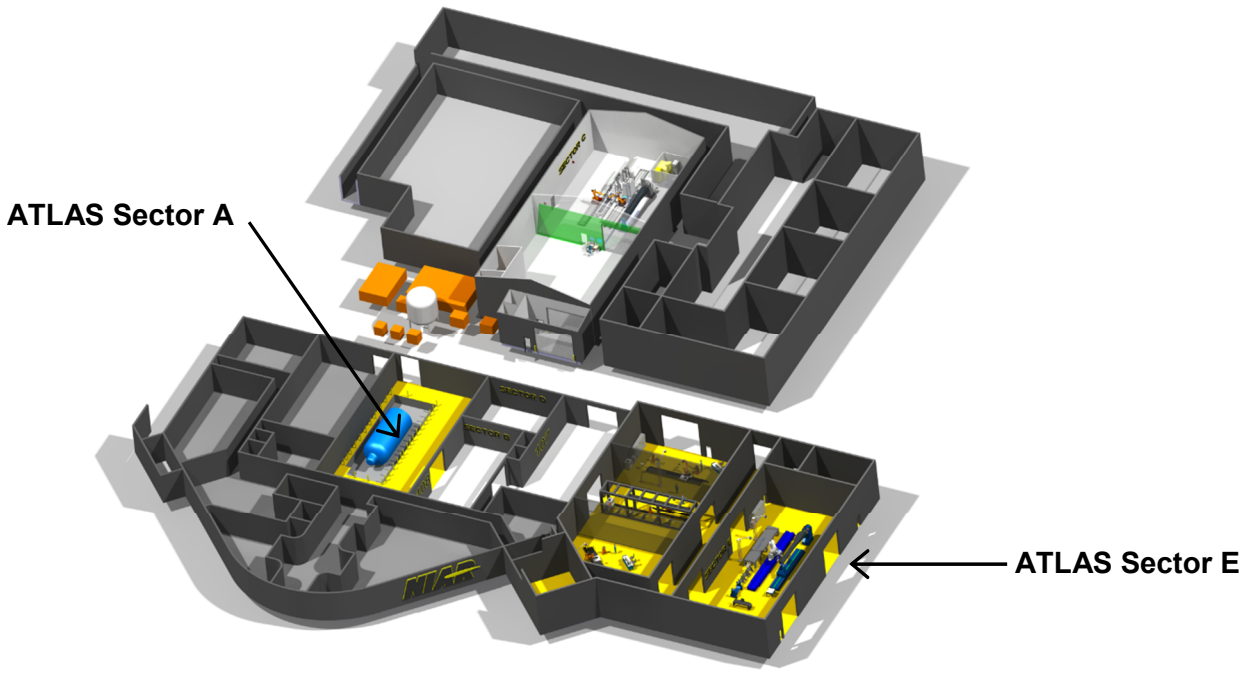
The project scope includes remodeling of a high bay laboratory space in NIAR building that is currently housing the Crash Dynamics Laboratory (this space will become available after the Crash Dynamics Lab building is complete and commissioned) as well as the construction of a 14,500 square foot addition (referred to as ATLAS Sector E) to the north side of the NIAR building in the location of Parking Lot 12. ATLAS has several new pieces of advanced equipment and several new projects that require significant expansion to the current NIAR footprint.

The remodeled high bay laboratory (referred to as ATLAS Sector A) will be the home to a 13 foot x 26 foot autoclave (WSU will be the only university in the world to operate an autoclave this large) and to several other advanced technologies such as tool-less robotic manufacturing and fiber patch placement technologies for complex structures.

The design and construction of the addition will produce a permanent single-story structure. The addition will consist of large single-story bays approximately 20 feet high to accommodate the advanced equipment. Overhead doors will be required in the bay areas. A concrete surface drive will be needed to access the overhead doors in these areas. The intent of the two large research bays is to maintain flexibility for future equipment installations by keeping the building structure out of the middle of the bays so the space can be subdivided as needed in the future.

The building addition will require demolishing the exterior freezer enclosure serving the composite laboratory and the existing single story pump/air compressor room on the north side of the building. The existing autoclave will be also removed from the building.

The structure of the addition will be complete, with the appropriate exterior and interior finishes, lighting, power and mechanical systems, parking and egress, drainage systems, interior and exterior signage, and landscaping to provide a complete, functional, relatively maintenance-free and aesthetically pleasing facility. The exterior finishes of the addition shall be consistent with existing NIAR facility.



The consultant shall review the specific requirements for the equipment being located in this building. These specific requirements will include electrical, mechanical and structural. The facility shall be designed and constructed to be as maintenance free as possible.

The surrounding NIAR research laboratories and offices shall remain operational during the construction of the laboratory renovation and building addition.

MECHANICAL and PLUMBING

Due to the nature of how the autoclave system operates, the mechanical HVAC system to condition the autoclave room will be heating only for the winter and forced ventilation for summer conditions. The mechanical hydronic system that is required to operate the autoclave system will require a cooling tower, cooling tower basin, primary/secondary pumps, cooling tower chemical filtration system and a sand filtration system. The autoclave system would also require a waste, natural gas and nitrogen gas as additional utility connections for its operation. Mechanical HVAC systems for the research cubes will be packaged variable volume roof top equipment. Each research cube will have its own single zone variable volume RTU to meet temperature and humidity control requirements. The established criteria by the owner is as follows: 19°C – 23°C (66.2°F – 73.4 °F)

(+/- 2°C) and 45%-50% RH (+/- 5%). Maintaining these temperatures are an absolute must to meet the standards for aviation research guidelines and standards. The design team will be required to work directly with the owner to establish the exact use of each research cube. If there is a need for any owner provided equipment that requires 20-40% of ventilation air or any form of make-up air, a dedicated ventilation system will be required to ensure requested conditions can be achieved during worst case ambient conditions. Plumbing systems for this space could potentially include emergency eye wash stations in each research cube. It is recommended to include additional floor drains in each research cube based on the final layout and use of each space. The single person restroom would include a floor drain, wall mount flush valve water closet with a wall mounted lavatory.

ELECTRICAL

The priority of the electrical system is to provide flexibility and capacity to integrate unknown future research equipment into the building for the university's use. The anticipated electrical service to the building will be a 277/480 volt, three phase, four wire, 800 amp service. However, the final service size will be determined by the equipment requirements. The main distribution panel will be capable of branch feeders of up to 250 amps, and will be initially sized to have at least 50% spare circuit breaker capacity. No back up or alternative sources of power are anticipated. General and workstation receptacles and data will be installed per WSU input. Lighting throughout the building will be LED lighting with footcandle levels in line with IES standards for the visual tasks to take place in each space. The NIAR fire alarm system will be expanded into this facility per WSU standards.

PROJECT FUNDING

This project will be funded from a combination of 1) NIAR restricted use funds (generated from industry revenues) and 2) grant funds.

It should be emphasized that the accuracy of construction estimates is critical to the successful completion of this project. The University expects that the project bid documents must have assurance of the ability to award a construction contract to provide the minimum requirements listed in the project description above. The bid documents may be required to include bid alternates that will permit award of a construction contract.

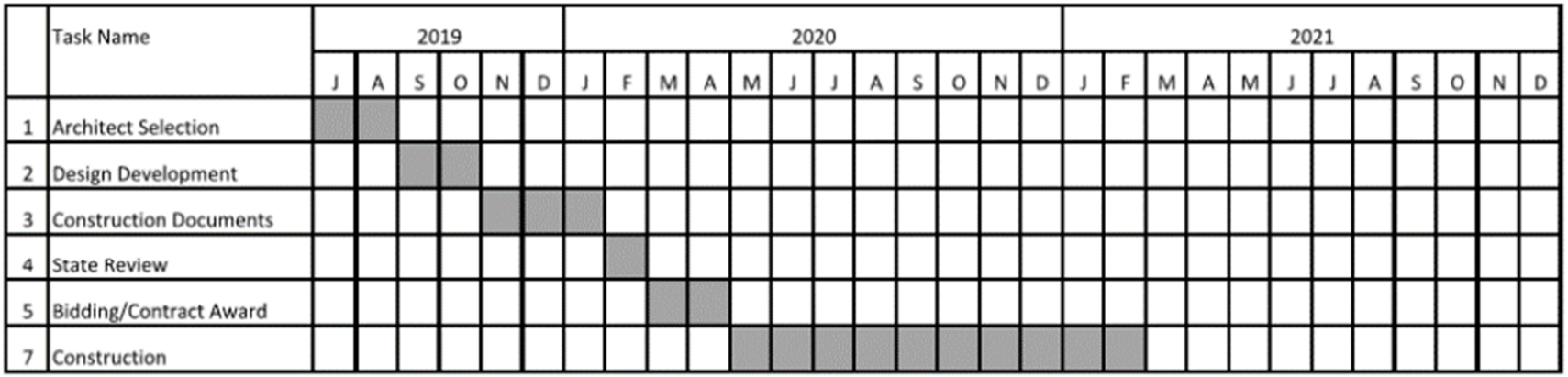
A project budget estimate is included within this document.

PROJECT SCHEDULE

Completion of the facility at the earliest possible date is essential. Therefore, the project consultants must meet all target dates and deadlines agreed upon with the University and defined at the initiation of design services.

The projected project schedule is included below.

PROJECTED SCHEDULE



COST OF SERVICING BUILDING

The cost of servicing the building addition will be provided through NIAR restricted use funds.

Wichita State University 5/21/2019
Wichita, Kansas

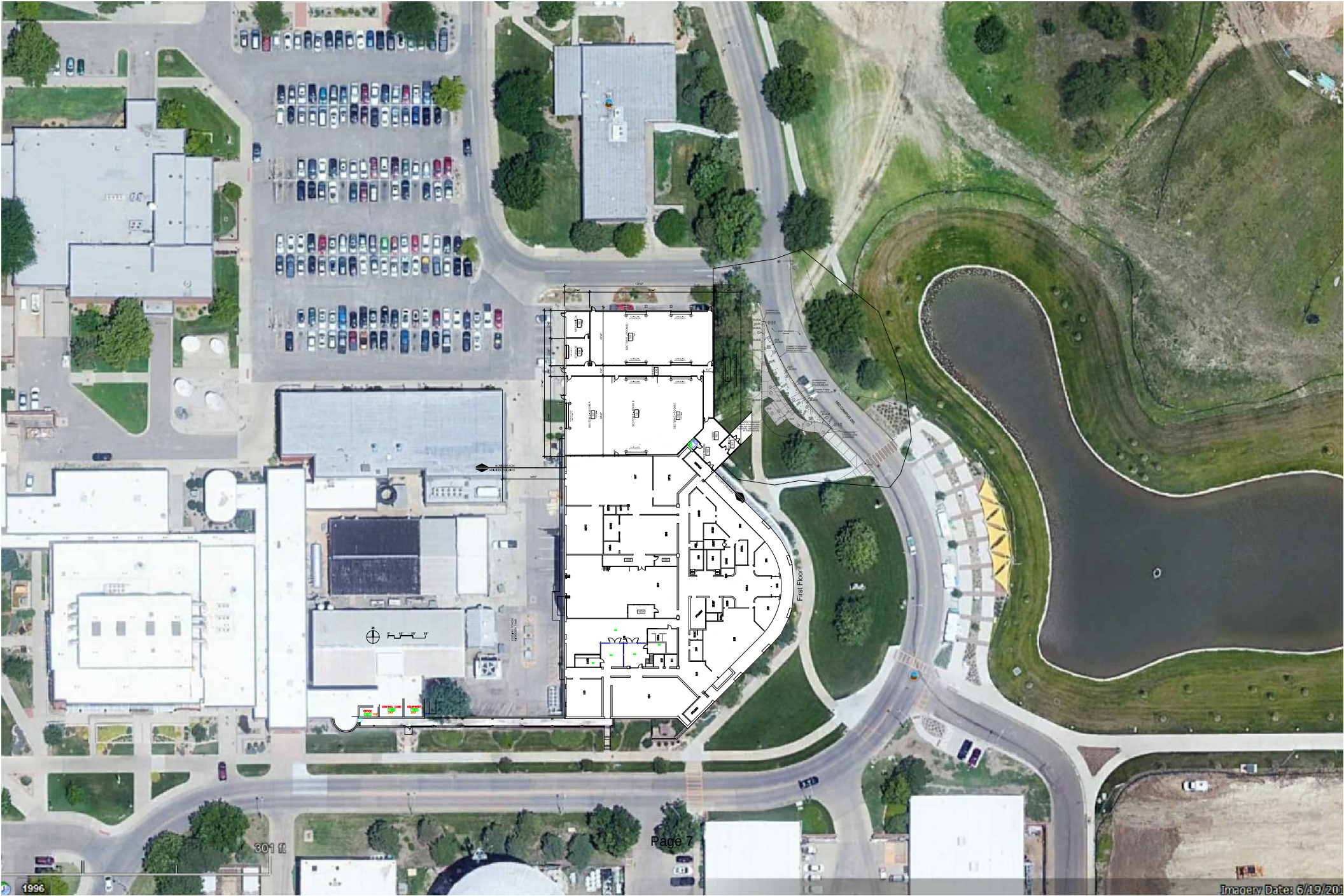
PRELIMINARY PROJECT BUDGET

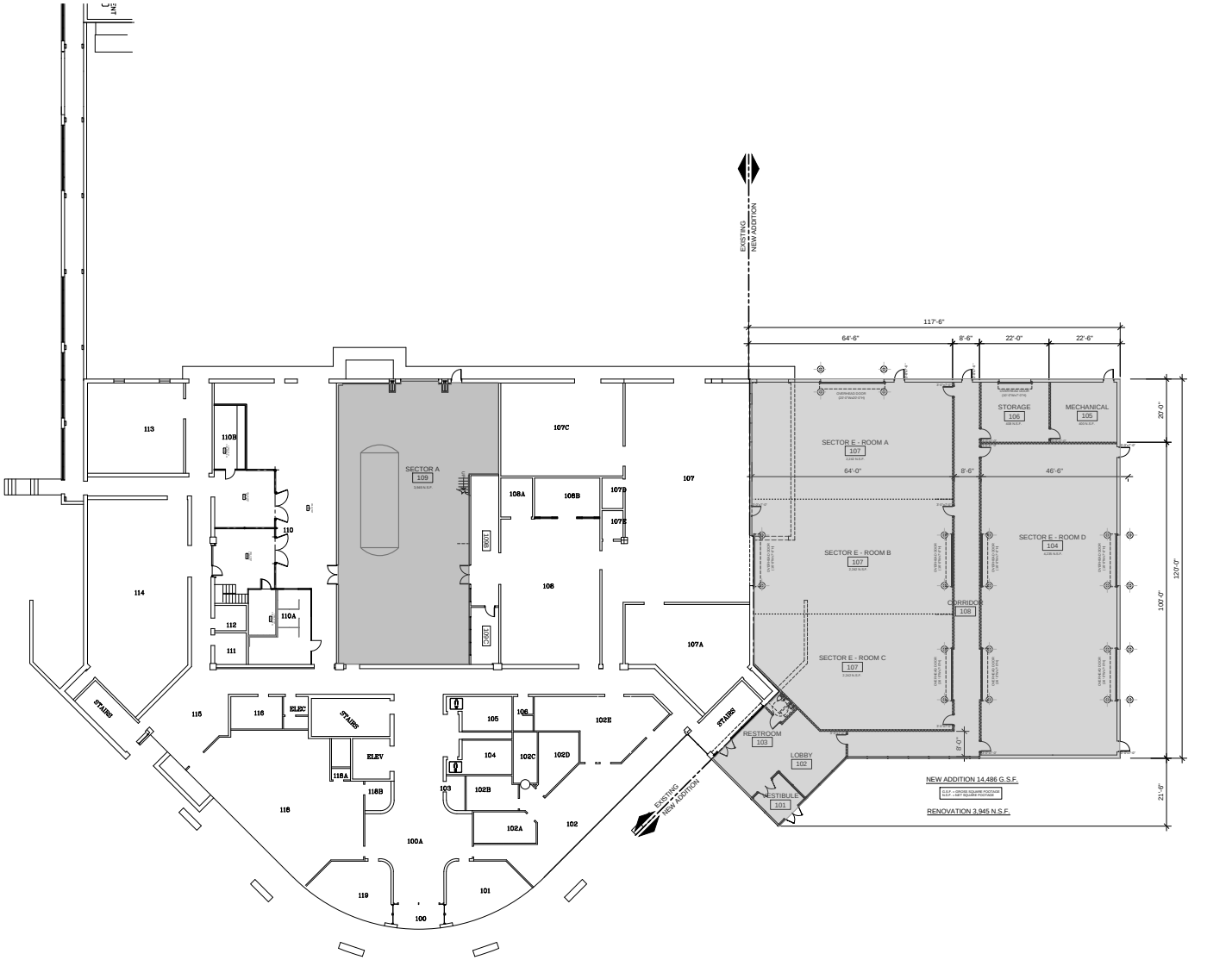
NIAR Renovation and Addition

The preliminary cost estimate is based on the following assumption and facts

* The costs are adjusted for the economic conditions of Wichita, Kansas
* Budget was prepared using 2019 Dollars

Item	Area	Cost/SF		Cost
A. Building Cost				
Renovation of High Bay Lab	3950	100	$	395,000
NIAR Addition	14500	250	$	3,625,000
Subtotal Building Cost			$	4,020,000
B. Fixed Equipment (X% of Building Cost)		1%	$	40,200
C. Site Development (X% of Building Cost)		2%	$	80,400
Demolition			$	25,000
Subtotal Site Development/Demolition			$	105,400
D. Total Construction (A+B+C)			$	4,165,600
E. Site Acquisition		0%	$	-
F. Fixtures, Furniture & Equipment (X% of Building Cost)		2.5%	$	100,500
G. IT Costs			$	150,000
H. AV			$	25,000
I. Security (# of Doors * $2500)	9 $	2,500	$	22,500
J. Installation/Moving Costs (X% of Building Cost)		1.0%	$	40,200
K. Professional Fees (X% of D)(includes survey and geotech)		7.5%	$	312,420
L. Contingency (X% of D)		10%	$	402,000
M. Admin/Fundraising costs			$	-
N. State (OFPM) Fee			$	33,000
O. Total Budget Required (D through N)			$	5,251,220


First Floor
301 ft
1996
Imagery Date: 6/19/201



First Floor

A ARCHITECTURAL FLOOR PLAN (NEW ADDITION)

0' 4' 8' 16' 24' 1/16"=1'-0"